

Dual-polarimetric radar-based tornado debris paths associated with EF-4 and EF-5 tornadoes over Northern Alabama during the historic outbreak of 27 April 2011

Lawrence D. Carey¹, Christopher J. Schultz², Elise V. Schultz², Walter A. Petersen³, Patrick N. Gatlin¹, Kevin R. Knupp², Andrew L. Molthan³, and Christopher B. Darden⁴

¹ Earth System Science Center, University of Alabama in Huntsville, Huntsville, AL

² Department of Atmospheric, University of Alabama in Huntsville, Huntsville, AL

³ NASA Marshall Space Flight Center, Huntsville, AL

⁴ National Weather Service Huntsville, Huntsville, AL

An historic tornado and severe weather outbreak devastated much of the southeastern United States between 25 and 28 April 2011. On 27 April 2011, northern Alabama was particularly hard hit by a large number of tornadoes, including several that reached EF-4 and EF-5 on the Enhanced Fujita damage scale. In northern Alabama alone, there were approximately 100 fatalities and hundreds of more people who were injured or lost their homes during the havoc caused by these violent tornadic storms.

Two long-track and violent (EF-4 and EF-5) tornadoes occurred within range of the University of Alabama in Huntsville (UAHuntsville) Advanced Radar for Meteorological and Operational Research (ARMOR, C-band dual-polarimetric). A unique capability of dual-polarimetric radar is the near-real time identification of lofted debris associated with ongoing tornadoes on the ground. The focus of this paper is to analyze the dual-polarimetric radar-inferred tornado debris signatures and identify the associated debris paths of the long-track EF-4 and EF-5 tornadoes near ARMOR. The relative locations of the debris and damage paths for each tornado will be ascertained by careful comparison of the ARMOR analysis with NASA MODIS (Moderate Resolution Imaging Spectroradiometer) and ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) satellite imagery of the tornado damage scenes and the National Weather Service tornado damage surveys.

With the ongoing upgrade of the WSR-88D (Weather Surveillance Radar – 1988 Doppler) operational network to dual-polarimetry and a similar process having already taken place or ongoing for many private sector radars, dual-polarimetric radar signatures of tornado debris promise the potential to assist in the situational awareness of government and private sector forecasters and emergency managers during tornadic events. As such, a companion abstract (Schultz et al.) also submitted to this conference explores “The use of dual-polarimetric tornadic debris signatures in an operational setting.”